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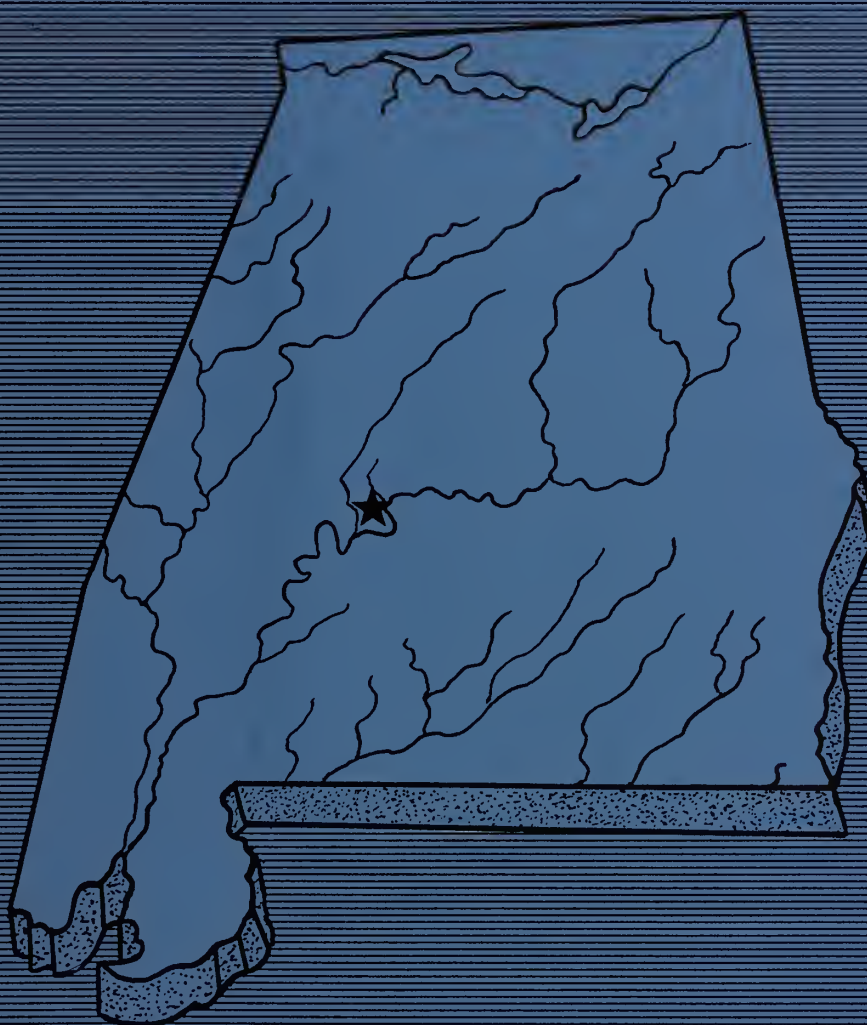
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WATERSHED WORK PLAN FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

MUSH CREEK WATERSHED



LOWNDES AND DALLAS COUNTIES
ALABAMA



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ADDENDUM

Mush Creek Watershed, Alabama

This Addendum shows the project costs, benefits, and benefit-cost ratio based on a 6-7/8 percent interest rate and current normalized prices. Annual project costs, benefits, and benefit-cost ratio are as follows:

1. Project costs are \$ 57,900
2. Project benefits are 78,200
3. The project benefit-cost ratio is 1.4:1

The alternative selected for implementation, as contained in this work plan, is based on a careful and deliberate consideration of the environmental and economic impacts of the project. There are no known unresolved environmental issues. Comments on the draft environmental statement stressed the need for a more detailed description of resources and problems. The final environmental statement has been modified in response to such comments.

November 1973

WATERSHED WORK PLAN AGREEMENT

Between The

Mush Creek Watershed Conservancy District
Dallas County Soil and Water Conservation District
Dallas County Commission
Lowndes County Soil and Water Conservation District
Lowndes County Commission
(Hereinafter referred to as the Sponsoring Local Organizations)

State of Alabama

and the

Soil Conservation Service
United States Department of Agriculture
(Hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Mush Creek Watershed, State of Alabama, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Mush Creek Watershed, State of Alabama, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. Except as hereinafter provided, the Sponsoring Local Organizations will acquire without cost to the federal government such land rights as will be needed in connection with the works of improvement. (Estimated cost \$109,900) The percentages of this cost to be borne by the Sponsoring Local Organizations and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations</u> (percent)	<u>Service</u> (percent)	<u>Estimated Land Rights Cost</u> (dollars)
All Structural Measures	100	0	\$109,900

2. The Sponsoring Local Organizations will provide relocation assistance advisory services, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organizations</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	41.44	58.56	*

*Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payment will be cost shared in accordance with the percentages shown.

3. The Sponsoring Local Organizations will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Two Floodwater Retarding Structures	0	100	579,100

4A. The installation cost of the critical area treatment, approximately 103 acres, will be shared on a division-of-work basis. The Service will provide seed, fertilizer, mulch and necessary land shaping. The Sponsoring Local Organizations will provide land preparation and apply seed, fertilizer and mulch.

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Costs</u> (dollars)
Two Floodwater Retarding Structures	0	100	39,500

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$1,000 and \$97,400 respectively.

7. The Sponsoring Local Organizations will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

8. The Sponsoring Local Organizations will provide assistance to landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work to be done in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program will be in compliance with all requirements respecting non-discrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of or be subject to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Dallas County Commission

Local Organization

By B. B. [Signature]

Title Chairman

Address Box 777 - [Signature] - 36701

Zip Code

Date July 10th 1972

The signing of this agreement was authorized by a resolution of the governing body of the Dallas County Commission adopted at a meeting held on July 10th 1972.

[Signature]
Secretary, Local Organization

Date 7-10-72

Lowndes County Commission

Local Organization

By C. P. Woodruff

Title Chairman

Address Lowndesboro

Zip Code

Date JULY 10, 72

The signing of this agreement was authorized by a resolution of the governing body of the Lowndes County Commission adopted at a meeting held on July 10, 1972.

[Signature]
Secretary, Local Organization

Date 7/10/72

Mush Creek Watershed Conservancy District
Local Organization

By Ralph Hardy

Title Chairman

Address Rt 1 Selma, Ala 36701
Zip Code

Date 8-3-72

The signing of this agreement was authorized by a resolution of the governing body of the Mush Creek Watershed Conservancy District adopted at a meeting held on 8-3-72.

[Signature]
Secretary, Local Organization

Date 7 Aug 1972

Dallas County Soil and Water Conservation District - Local Organization

By Cliff Calkins, Jr.

Title Chairman

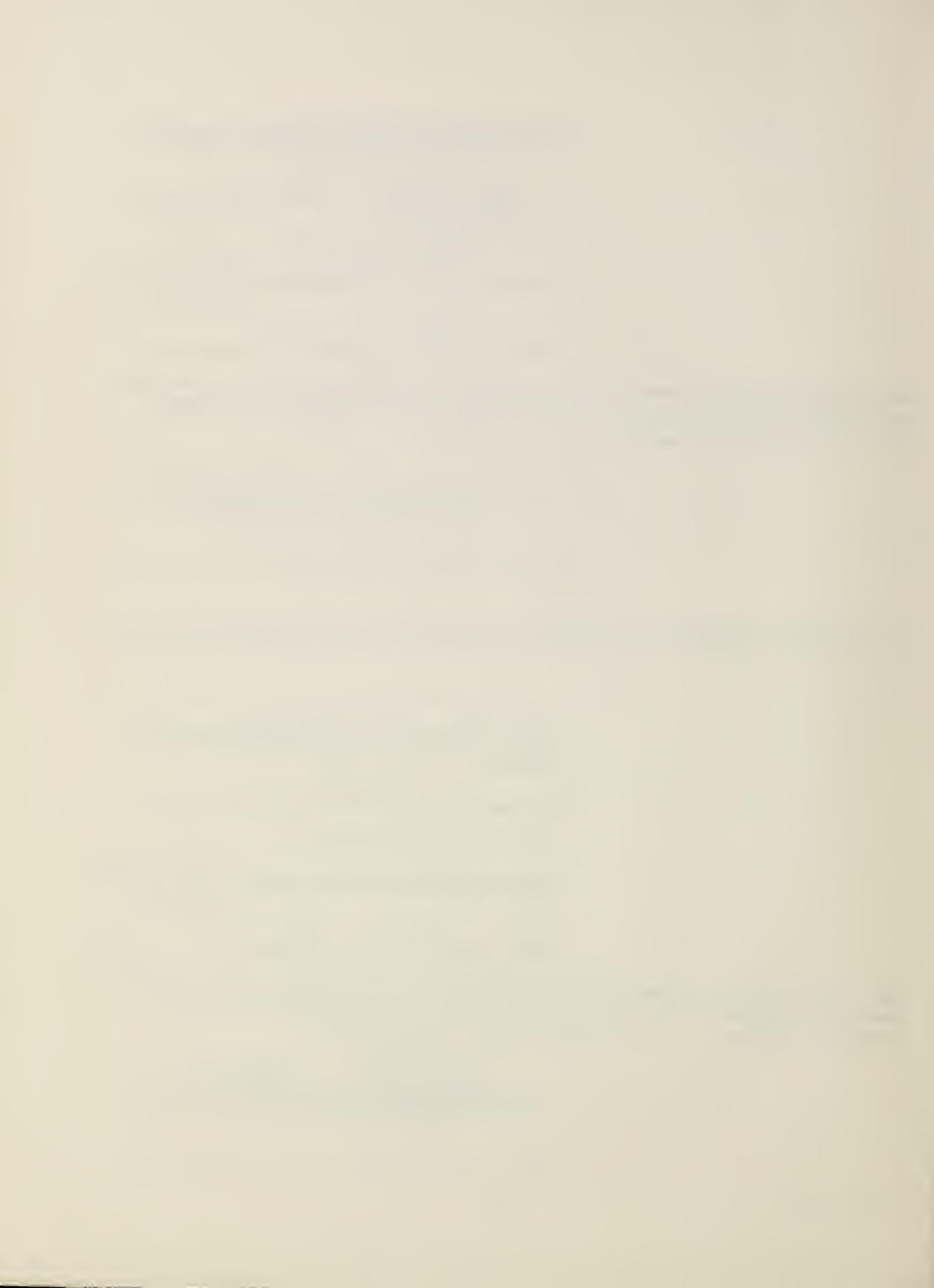
Address Marion Junction, AL 36759
Zip Code

Date 7-26-72

The signing of this agreement was authorized by a resolution of the governing body of the Dallas County Soil and Water Conservation District adopted at a meeting held on 7-26-72.

[Signature]
Secretary, Local Organization

Date 7-26-72



Lowndes County Soil and Water Conservation
District - Local Organization

By Edward Lyon

Title Chairman

Address Route 1, Box 86, Tyler, Al.

Zip Code

Date July 13, 1972 36785

The signing of this agreement was authorized by a resolution of the governing body of the Lowndes County Soil and Water Conservation District adopted at a meeting held on 13 July 72.

Harold E. Pate

Secretary, Local Organization

Date 13 July 72

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

By Kenneth E. Hunt

Date DEC 19 1973

WATERSHED WORK PLAN
FOR
MUSH CREEK WATERSHED
LOWNDES AND DALLAS COUNTIES, ALABAMA

Prepared under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended.

Prepared By: Mush Creek Watershed Conservancy District
Dallas County Commission
Lowndes County Commission
Dallas County Soil and Water Conservation District
Lowndes County Soil and Water Conservation District

With Assistance By: U. S. Department of Agriculture,
Soil Conservation Service
U. S. Department of Agriculture,
Forest Service

May 1972



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WATERSHED WORK PLAN

MUSH CREEK WATERSHED

Lowndes and Dallas Counties, Alabama

May . 1972

SUMMARY OF PLAN

This plan for flood protection for Mush Creek Watershed, Lowndes and Dallas Counties, Alabama, was prepared by the Mush Creek Watershed Conservancy District, the Dallas County Commission, the Lowndes County Commission, the Dallas County Soil and Water Conservation District and the Lowndes County Soil and Water Conservation District as cooperating local organizations with technical assistance by the Soil Conservation Service and the U. S. Forest Service. Lowndes County is designated by the Public Works and Economic Act of 1965 as an area of chronic unemployment and is eligible for benefits under the Act.

The watershed area is 38,726 acres of which 25,728 are in Dallas County and 12,998 in Lowndes County. Approximately 3,100 acres of land are subject to flood damages in the watershed. Damaging floods are limiting agricultural production in the flood plain. The proposed project measures will reduce flood damages approximately 67 percent.

Works of improvement planned:

(1) Land treatment measures planned include tree planting, timber stand improvement, water disposal systems, field borders, farm ponds, pasture and hayland planting, pasture management, and wildlife habitat management. These measures will be installed during a 5-year installation period by individual landowners and operators in cooperation with the Soil and Water Conservation Districts. The estimated cost of installing these measures is \$471,300 of which \$44,200 (9%) is from P. L. 566 funds and \$427,100 (91%) from Other funds. Approximately 103 acres of critical areas will be treated on a division-of-work basis at an estimated cost of \$25,900.

Landowners and operators will maintain land treatment measures in cooperation with the Soil and Water Conservation Districts.

(2) Structural Measures - proposed structural measures are two floodwater retarding structures. The Dallas County Commission will install the structural measures by contract during a 5-year installation period. The estimated installation cost is \$826,900 of which \$716,000 will be borne by P. L. 566 funds and \$110,900 from Other funds.

The Mush Creek Watershed Conservancy District and the Dallas County Commission will be responsible for operation and maintenance of Structure No. 2; the Conservancy District and the Lowndes County Commission will be responsible for Structure No. 5. Approximately 3,100 acres of land will be benefited by the structures. The flood plain land has a very high agricultural potential and is valued as high as \$400 per acre. No significant change in acreage of allotted crops is expected.

Without project, annual flood damages are estimated to be \$55,400. Proposed project measures are expected to reduce damages approximately 67 percent to \$18,300. Total average annual benefits are \$60,700; and the total average annual costs are \$45,700, giving a benefit-cost ratio of 1.3:1.

DESCRIPTION OF THE WATERSHED

Physical Data

Location and Size - The Mush Creek Watershed comprises a drainage area of approximately 38,726 acres in Lowndes and Dallas Counties, Alabama. Of this total, 12,998 acres are in Lowndes County and the remaining 25,728 acres are in Dallas County. Mush Creek Watershed is located 36 miles west of Montgomery (population 129,375), and 12 miles south of Selma, Alabama (population 26,941).

The watershed is 14 miles long and has an average width of about four miles. Mush Creek originates near the community of Collirene in western Lowndes County and flows in a westerly direction to its confluence with Cedar Creek. In turn, Cedar Creek empties into the Alabama River approximately three miles further to the west.

The average annual rainfall in this area is 52 inches. Short periods of very dry or very wet weather are common. Normally, October is the driest month and March the wettest. During the spring months, thunder storms and intense showers of short duration are common. Although severe droughts are uncommon, dry conditions usually prevail from midsummer to late fall. The growing season is approximately 210 days, with the last killing frost in April and the first in October.

Hydrologic conditions of the forested lands, rated against optimum conditions for the locality, range from very poor to very good as follows: 15 percent, very good; 30 percent, good; 10 percent, fair; 30 percent, poor; and 15 percent, very poor. About two-thirds of the present forested area consists of old fields showing evidence of considerable damage from past erosion. Under the existing forest cover, however, most of the old erosion scars have healed and current erosion is negligible to light on 85 percent of the area and moderate on the remainder.

Geology and Soils - The watershed lies in the Alabama--Mississippi Blackland Prairies (Blackbelt) Land Resource Area. Geology includes chalks and marls of the Selma group of Upper Cretaceous Age and residual soils derived therefrom. The northwest and eastern portions of the water-

shed produce large amounts of sandy and gravelly alluvial materials. These materials are apparently old river deposits which are a result of overflow and other stream action.

Upland soils are slowly permeable sandy clays with resultant high runoff and high sheet erosion rates. Flood plain soils consist of materials derived from the uplands and deposited by stream actions. Most of the flood plain soils are clays, silty clays, and sandy clays which are slowly draining productive soils in land capability classes IIw and IIIw. Predominate upland soils include Savannah and Kipling while the flood plains consist mostly of Kipling and Leeper soils.

Topography - The topography of the watershed varies from gently rolling to steep. Wide, flat flood plains occur along Mush Creek and its tributaries especially in the central and western portions of the watershed. Elevations range from 90 to 500 feet above mean sea level, giving a total relief of 410 feet.

Economic Data

The economy of the watershed is oriented around the production, marketing, and processing of agricultural products and services. Major farm enterprises are soybeans, cotton, beef cattle, and forest products. Production of intensive row crops in the flood plain is limited because of the flood hazard. The flood plain is divided into relatively large privately-owned farms.

Land use in the watershed is approximately 6,700 acres of cropland, 8,660 pasture and hayland, 22,229 acres of woodland, 750 acres of idle land, and 387 acres of miscellaneous use.

The future without project land use of the 3,062 acres of flood plain land is 2,257 acres of cropland, 605 acres of pastureland, and 200 acres of woodland and idle. The flood plain land use with the project is expected to be 2,300 acres of cropland, 600 acres of pastureland, and 162 acres of woodland and idle.

Lowndes County is designated by the Public Works and Economic Development Act of 1965 as being eligible for benefits under the Act. According to the 1964 Census of Agriculture, approximately 75 percent of commercial farms have gross sales of less than \$2,500 and 15 percent of commercial farms have gross sales exceeding \$10,000 in Lowndes County. In Dallas County, about 80 percent of commercial farms have gross sales of less than \$2,500 and 12 percent have gross sales exceeding \$10,000. The farms in the watershed range in size from 20 to 5,000 acres, with the average size approximately 640 acres. There are approximately 60 farms in the watershed. Land value ranges from \$150 an acre in the upland to \$400 an acre in the flood plain.

The watershed is served by a number of farm-to-market roads which connect with State Highway 41 that crosses the watershed. These highways pro-

vide adequate accessibility to markets. Selma provides the principal market for agricultural products.

All of the forest land is in private ownership and consists of farm woodlots averaging about 300 acres in size. Some 7,000 acres, or about 30 percent of the total forested area, are leased and managed by timber industries. Little change in the forest land ownership pattern is expected.

Commercial forest products, primarily sawtimber and pulpwood, make an appreciable contribution to the local economy. Essentially all the timber stands have been cutover during the past 60 years, but generally favorable site conditions have produced good regrowth. About 15 percent of the forested area could now benefit from an improvement cut to remove merchantable material and improve the composition and spacing of the growing stocks.

Forest fires have been a problem in the past but the situation is much improved at present as a result of improved fire protection and increased area under industrial management.

Fire records for the period 1965-1969 show an average occurrence of six fires per year and an annual burned area of 210 acres within the watershed. Fire protection is provided by the Alabama Forestry Commission, through the cooperative forest fire control program, at a cost of approximately \$1,600 per year.

The Alabama Forestry Commission, in cooperation with the U. S. Forest Service, through various federal-state cooperative forestry programs, is providing forest management assistance, forest fire prevention and suppression, distribution of planting stocks, and forest pest control assistance to private landowners in the watershed.

Land Treatment Data

The Lowndes and Dallas Counties Soil and Water Conservation Districts have assisted 44 watershed landowners with conservation plans for their farms. These plans cover 31,560 acres or 82 percent of the watershed area. A study of work unit records shows that approximately 60 percent of the planned land treatment measures have been applied at a cost of \$322,195.

The Districts have assisted landowners in establishing land treatment measures such as conservation cropping systems, pasture management, hayland planting, tree planting, farm ponds, water disposal systems and drainage mains and laterals.

Forestry land treatment measures applied within the watershed during the past ten years include tree planting on 950 acres at an estimated cost of \$22,300, release cutting on 200 acres at a cost of \$4,000, and fire protection of the entire forested area at a cost of \$16,000.

Most of the forested lands are situated in the uplands. Anticipated changes in land use without a project during the next decade will involve the

conversion of approximately 1,450 acres of forest land to cropland and pasture and about 470 acres now in other uses to forest. The total area now in forest is expected to decrease about 4 percent with most of the shrinkage occurring in the uplands. The forests are capable of producing high quality sawtimber in the next decade. Their loss will result in increased sediment carried by runoff from land converted to pasture and crops. This is in addition to losses of forest habitat for wildlife, particularly in terms of mast production utilized by squirrel and deer. Upland converted to forest is expected to require the planting of conifers.

Fish and Wildlife Resource Data

Fish - The fishery in Mush Creek and its tributaries is of low value. Principal species of sport fish are bass, bluegill, mullet, bullheads, channel cat, crappies, and various sunfishes. Fishing activity is generally low throughout the watershed. Fishing success is also low except in managed fish ponds and during spring when mullet and crappie are caught from the lower reaches.

Wildlife - Wildlife population's range from low to moderate. Rabbit and quail are moderate in number. Hunting activity is low for rabbits and high for quail. Squirrel and dove populations are low; hunting activity is also low. Deer and wild turkey populations are moderate. Hunting activity is low for deer and moderate for wild turkey. Fox and raccoon populations are moderate; hunting activity for these species is low. Other furbearers are moderate in number, but trapping is low. With the exception of wood duck, waterfowl are of little importance. Wood ducks frequently congregate in a beaver pond which will be inundated by a floodwater retarding structure.

WATERSHED PROBLEMS

Floodwater Damages

The land along Mush Creek and its tributaries is subject to frequent flooding. Damaging floods occur one to three times each year, and damaging floods are limiting the potential flood plain production. Average annual acres flooded is approximately 1,470 acres. Flooding has increased the management problems relating to proper use of the bottom land soil. Many landowners are growing row crops on the uplands rather than on the flood plain. This reduces income as well as increasing erosion on the upland. The quality of agricultural products is decreased by flooding, resulting in reduced value and income to farmers.

Streambank erosion is a problem in the watershed. The erosion makes it impossible for landowners to maintain stream crossings. Land is being destroyed by the bank cutting.

Other agricultural damages are significant. Many fences are destroyed by each flood. Fence repair and removal of flood debris are necessary each year. Water gaps and crossings are heavily damaged by each flood. Farm roads and drainage ditches are damaged by debris deposited from floods.

Non-agricultural damages are not severe, but it is necessary to remove flood debris from bridges each year. Also, road fills require additional fill material after each large flood.

During the 100-year evaluation period, flood damages without project conditions were estimated to be \$55,400 annually.

A summary of these damages are:

Agricultural	
Crop & Pasture	\$44,400
Other Agricultural	1,700
Scour	3,800
Sediment	300
Non-agricultural	
Road and Bridge	600
Indirect	4,600

Erosion Damage

Practically all the erosion damage to uplands in the watershed consists of loss of soil from cropland and pasture as a result of sheet erosion. Sheet erosion causes a reduction in fertility in the fields and exposes less fertile, more easily erodible subsoil to attack by wind and water. The natural erosion rate in the watershed is high because of the high percentage of rainfall that runs off these soils. Critically eroded areas occur on less than 1 percent of the watershed.

At present, roadside erosion is not severe but a potential hazard exists if maintenance of vegetation is not accomplished. The erosion of roadbanks results in filling of ditches and roughness of unpaved roads which add to the cost of road maintenance. In addition, unsightly public roads are created.

Flood plain erosion causes approximately \$3,800 average annual damages from minor scour channels. These scour channels cause a loss of productivity by removal of productive soil and lower the quality of pasture plants due to water standing in the channels. Several years may be needed for farming operations and natural processes to rebuild fertility and smooth the scoured land.

Sediment Damage

Sediment production from Mush Creek Watershed is moderate. The sediment is deposited on the flood plains as a widespread, fine-grained material or as sandy deposits which are less productive than the underlying soil. The fine-grained sediment deposited on the flood plain does not generally cause extensive damage to crops or pasture, rather the flood which deposits this sediment is probably the more damaging factor.



Flooding from Mush Creek deposits debris on pasture. The quality of pasture is damaged because of weed seeds being washed on pasture.



Floodwater from Mush Creek causes extensive bank cutting, sand bars and debris accumulation.



Swiftly moving floodwater from Mush Creek spreads sand over pastures and uses up valuable land.



Raging floodwater on Mush Creek up-roots trees, creates sand bars, and destroys pastureland.

Problems Relating To Water Management

Drainage - Necessary drainage in this watershed can be accomplished with farm drainage systems.

Fish and Wildlife - There is little management of fish and wildlife resources in the watershed. A need exists for properly managed fish ponds and improvement of food, cover, and water for wildlife.

PROJECTS OF OTHER AGENCIES

This watershed is located in the Alabama River Basin. Mush Creek drains into William Danley Reservoir, which is operated by the Corps of Engineers. Works of improvement contained in this plan will not adversely affect the operation of the reservoir.

BASIS FOR PROJECT FORMULATION

Project formulation was based on the following objectives which were established by the sponsors: (1) accelerate the rate of application of conservation measures to reduce runoff and erosion on uplands, (2) stabilization of active sediment contributing critical areas, (3) reduce flood damages by 70 percent along Mush Creek, and (4) provide job opportunities for unemployed and underemployed labor resources. These objectives were agreed to by the Service.

Land treatment is the basic element in formulating this watershed project. Land treatment measures will (1) be effective in reducing erosion damages, (2) reduce runoff and sediment production that would adversely affect the operation, maintenance, and useful life of the proposed works of improvement, (3) stabilize critical areas that are major sediment producing areas, (4) assure full realization of project benefits, and (5) increase the efficiency of land use on all farms.

The land treatment program was developed from a field survey of the watershed and is based on needs not being met by the going programs. The extent of anticipated accomplishment is limited by the length of the installation period and expected landowner participation.

Forestry management goals within the watershed are:

1. Reduce erosion and runoff from forest lands.
2. Increase forest productivity.
3. Reduce damage to timber and watershed values from forest fires.

To meet these goals, the forest land treatment was developed from a field survey of the watershed, and is based on needs over those being met by other programs.

The basic needs to be met are:

- a. Reforestation of 450 acres of lands now in crops, pasture, idle or miscellaneous uses which will be converted to forest land use.
- b. Release of desirable species on 2,200 acres of overstocked immature stands.
- c. Improvement cuts on 3,300 acres to remove certain merchantable trees and improve the composition and growing conditions in the residual stand.
- d. Animal control for grazing damage on 2,200 acres.
- e. Management plans on approximately half the area.
- f. Adequate protection from forest fire damage.

It would be unrealistic to expect that the treatment needs of the watershed can be satisfied; therefore, the basic needs program proposed is a result of the limitation anticipated by expected landowner participation and the length of the installation period.

A study was made of the watershed to locate floodwater retarding sites. Four floodwater retarding structures and approximately two miles of channel improvement was the first combination of structural measures evaluated. These floodwater retarding structures alone would not provide an acceptable level of protection. The proposed channel improvement was not acceptable because of excessive velocities.

The next combination of structural measures consisted of two larger floodwater retarding structures. These structures will provide reduction of flood damages of approximately 67 percent which essentially meets project objectives as set by the sponsors.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment is considered the basic element in formulating a watershed program. Technical assistance will be made available to landowners who apply needed land treatment measures. The prime objective of the program is to use each acre of land within its capabilities and treat it according to its needs. These measures will be planned and applied under an accelerated program of the Lowndes and Dallas County Soil and Water Conservation Districts.

Measures will be planned and applied to hold soil loss at the minimum level as reflected in the work unit technical guides. Land presently being used beyond its capabilities will be converted to use within its capability. Water disposal systems will be installed to control runoff, reduce erosion, and provide adequate water disposal systems for the upland. Surface drainage ditches and stream channel improvement will be installed to provide an effective

means of controlling erosion and removing runoff from the upland and small tributaries.

Conservation cropping systems will be applied to the cropland to keep soil loss within acceptable limits. Practices that make up a conservation cropping system are contour farming, crop rotations, crop residue management, cover crops, and engineering practices as needed. Conservation measures on grassland include the establishment of permanent vegetation and the proper use and management of established grasses. Associated engineering practices such as ponds and drainage will be used to assure proper use of pastures.

Approximately 103 acres of critical areas will be stabilized. These areas are major silt contributing areas and are located as shown on the critical area map (Figure 2).

Interested landowners will be encouraged to install land treatment measures that will improve habitat for fish, forest game, waterfowl; and farm game as income-producing recreation, or as home-use hunting and fishing. These land treatment measures will enhance fish and wildlife resources in the watershed.

Local landowners will stock farm ponds according to standards and specification of work unit technical guides. Fish will be furnished by state, federal, and private fish hatcheries.

Land treatment measures for forest land consist of the following:

1. Tree Planting - Watershed Protection (470 acres)
Reforestation of appropriate open land is necessary to adjust land use with capability and to reduce runoff and erosion through the protective function of forest cover.
2. Stand Improvement Measures (5,780 acres)
These operations are aimed at improving hydrologic conditions by manipulation of stand composition to create favorable conditions for the maximum production and protection of litter, humus and forest cover. Included are the removal of inferior species and cull trees to release desirable trees, and improvement harvest cuttings, while leaving adequate game food and den trees for wildlife habitat.
3. Fencing for Animal Control to Reduce Damage (2,200 acres)
Control grazing on 2,200 acres to reduce sheet erosion damage by fencing to limit grazing in those areas showing soil movement directly related to compaction from grazing animals.
4. Cooperative Forest Fire Control Program
Forest fires burned an average of 0.94 percent of the forest land annually during the 1965-1969 period, thus exceeding the state fire loss index goal of 0.25 percent and the small watershed goal of 0.20 percent. However, the fire protection program

for the watershed has been substantially improved recently and the Alabama Forestry Commission feels that protection goals can be reached without extraordinary equipment or manpower requirements. Intensified fire protection for the watershed will be provided through the going program with accelerated capital outlay only during the installation period.

5. Accelerated Technical Assistance

Technical assistance now being provided under the cooperative forest management program will be accelerated during the installation period to assist small landowners in the application of the forestry measures proposed.

Structural Measures

Two floodwater retarding structures are planned at locations shown on the project map (Figure 1). The details of the structures are shown in Table 3.

The present land use of the two areas where structures are planned includes 292 acres of pastureland, 505 acres of woodland, and 30 acres of row crops. In consideration of future trends in the watershed within the next five years, land use without the project is expected to be 350 acres of pastureland, 427 acres of woodland, and 50 acres of cropland.

The borrow areas, spillways, and embankments of the two floodwater retarding structures occupy 60 acres of land that were previously used for woodland (33 acres), pasture (17 acres), and row crops (10 acres).

The floodwater retarding structures provide for the detention of 9,431 acre-feet of floodwater storage. This is equivalent to 6.96 inches of runoff from the area controlled by the structures. At the confluence of Mush Creek and Cedar Creek, 42 percent of the Mush Creek drainage area is controlled by the floodwater retarding structures.

The principal spillways are planned to be constructed on a yielding foundation. Principal spillways will have single-stage inlets and will outlet into excavated stilling basins. Reservoir capacity provides for the 100-year sediment accumulation; however, initial water storage will only be to the 50-year sediment level in Structure No. 2. Initial water storage at the 50-year sediment pool level in Structure No. 5 will produce an undesirable impoundment. Initial water storage to the 100-year sediment level will correct this condition.

A water level control gate will be installed in both structures to permit seasonal variation (2 to 4 feet) of water levels to mitigate the damages that will occur to waterfowl habitat along the stream channels and in the flood plain.

The emergency spillway at Structure No. 2 is designed to permit passage of the runoff from a 9.6 inch, 6-hour rainfall using an antecedent

moisture condition of $II\frac{1}{2}$. Structure No. 5 has an emergency spillway designed to permit passage of the runoff from a 16.3 inch, 6-hour rainfall using an antecedent moisture condition of $II\frac{1}{2}$. The material in the emergency spillways consists of CL's and CH's. Excavated materials in emergency spillways plus SC and SM materials on edges of flood plain areas will provide the fill material for the floodwater structures. The water table may limit the use of material within the sediment pool as borrow material. There are no depressions in the flood pool reservoir areas that will retain water following flooding. Installation of the structures will require the raising or rerouting of a county unpaved road located in the flood pool of Structure No. 2.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The total estimated cost of land treatment is \$471,300 of which \$44,200 is from P. L. 566 funds and \$427,100 from Other funds.

The estimated total cost of the forestry program for the watershed is \$124,200. Of this total \$14,100 are P. L. 566 funds and \$110,100 are from other sources.

The \$14,100 of P. L. 566 funds will be expended for technical assistance. The Alabama Forestry Commission will provide additional accelerated technical assistance valued at \$2,600 and continued technical assistance under the going Cooperative Forest Management Program will amount to \$1,100 during the installation period.

The going Cooperative Forest Fire Control Program, valued at \$8,700 during the installation period, will be supplemented by accelerated capital outlay of \$3,300 for increased fire protection activities.

The cost of land treatment on cropland and grassland is estimated to be \$347,100 of which \$30,100 is from P. L. 566 funds and \$317,000 from Other sources. P. L. 566 funds will furnish \$9,800 for accelerated technical assistance. The going program will also provide \$5,000 for technical assistance.

Land treatment costs for open land include a combination of conservation practices such as contour farming, cover crops, field border, and vegetated waterways for cropland and pasture planting, pasture management and surface drainage in pastureland.

Technical assistance costs include cost of conservation planning, technical assistance in applying measures, and soil surveys.

The cost of critical area treatment is estimated to be \$25,900. This work will be accomplished through a division of work with the Soil Conservation Service using P. L. 566 funds to furnish seed, fertilizer, mulch, and shaping. Local sponsors, through a cooperative agreement with land-

owners will prepare the seedbed and apply seed, fertilizer and mulch, and do any repair that may be necessary to establish the areas.

Structural Measures

Two floodwater retarding structures will be installed at a cost of \$826,900 of which \$716,000 are P. L. 566 funds and \$110,900 are Other funds.

The P. L. 566 funds include \$579,100 for construction and \$39,500 for engineering. The construction cost for structural measures includes the estimated cost of all materials and labor necessary for the installation of the measures. The cost of engineering services includes the direct cost of engineers and other technicians for surveys, investigations, design and preparation of plans and specifications for structural measures including the associated vegetative work. The unit price assigned each quantity is based on local prevailing prices (1972) and previously constructed projects. A contingency of 12 percent was added to cover unforeseen items of cost during construction.

Other funds for land rights are estimated to be \$109,900. Included in the land rights cost are \$15,000 for relocation of a road and bridge and \$4,000 for relocation of utility lines in the flood pool of Structure No. 2.

Project administration cost includes the cost of contract administration and inspection services during construction of structural measures. The PL-566 cost of project administration is estimated to be \$97,400. The cost of project administration by the sponsors is estimated to be \$1,000. The Soil Conservation Service responsibility in project administration will include contract administration, review of engineering plans, and any necessary inspection service during construction to insure that structural measures are installed in accordance with the plans and specifications. The Soil Conservation Service and the sponsoring local organizations will bear all the expenses they incur. The Other funds are the cost for administering the contracts, which include cost of legal services, advertising for bids, and other administrative costs in handling contracts.

It is estimated that funds for structural measures will be obligated as follows:

<u>Year</u>	<u>P. L. 566</u>	<u>Other</u>	<u>Total</u>
1	\$ 19,100	\$ 40,700	\$ 59,800
2	281,500	42,000	323,500
3	20,400	17,700	38,100
4	395,000	10,500	405,500
TOTAL	\$716,000	\$110,900	\$826,900

EFFECTS OF WORKS OF IMPROVEMENT

This project will enhance general economic conditions of the area by reducing flood damages, providing job opportunities, increasing net income, and encouraging more efficient utilization of available resources.

Planned land treatment measures will reduce erosion, increase infiltration rates, and assure the realization of benefits used in the justification of the structural works of improvement.

Damages from a 25-year frequency flood will be reduced from \$82,800 to \$39,800.

Structural measures will benefit approximately 3,100 acres of flood plain. Average annual acres flooded will be reduced from approximately 1,500 to 460, a reduction of 70 percent. The 10-year frequency flood, considered a major flood by local landowners, will inundate 1,250 acres after project installation as compared to 2,300 acres without the project.

The reduction in frequency of flooding will enable landowners to more intensively use 730 acres. This change in cropping pattern will be one of taking row crops off marginal land and returning them to the flood plain. The marginal land taken out of crops will be established to a more suitable cover of grasses, legumes, or trees.

Planned project measures will decrease the frequency of flooding significantly. Damages will be reduced by 67 percent.

Benefits from the reduction of flood hazards will improve economic conditions in the watershed. These benefits are primarily in the form of reduced flood damages to crops and pasture, fixed improvements, and public roads and bridges. More efficient use of resources will result in reduced costs per unit of output. Approximately 17 landowners will be benefited by structural measures. The 17 landowners employ about 25 full-time employees whose families will benefit from the project measures. Many of the employees are in a very low economic group.

Open land treatment measures will reduce (1) runoff, (2) erosion, and (3) sediment deposition. The measures will increase the productivity of the open land and preserve the land for future generations. The increased productivity will result in increased profits to landowners and operators.

The combined effect of proposed land treatment and floodwater retarding structures will reduce sediment deposited in Mush Creek channel and William Danley Reservoir. Land treatment measures will reduce sheet erosion, and floodwater retarding structures will provide for approximately 1,580 acre-feet of sediment storage.

Increased profits by local industries will increase demand for transportation, processing, and marketing of the increased production. The additional income of landowners and industry will have a multiplier effect. The multiplier effect is expected to be unusually large because of the low overall economy of the project area.

The installation of floodwater retarding structures will affect the environment by covering 170 acres of woodland, 40 acres of pastureland, and 3 acres of cropland in water and/or sediment. This area will be lost for the above uses during the next hundred years. The type woodland to be cleared is mainly pine. Principal species are loblolly pine, various oaks, sweet gum, and red maple. Also, the retarding pools will require a land use that is compatible with frequent flooding. The retarding pools require 614 acres which are now 47 acres of cropland, 310 acres of pastureland and 257 acres of woodland. The 47 acres of cropland and 310 acres of pastureland will be changed to woodland or the pastureland will remain the same if the type pasture will tolerate frequent flooding. The 257 acres of wood-

land in the retarding pools is expected to remain in woodland and will provide habitat for wetland wildlife. The 60 acres of land for the dams, spillways, and borrow areas will be vegetated to prevent soil erosion and this vegetation will provide food and cover for some species of wildlife. This area will also provide limited grazing for livestock.

The two sediment pools will provide approximately 213 surface acres of water which will furnish habitat for fish and wetland wildlife. These sediment pools will become less desirable for fish production as they fill with sediment. These two sediment pools will have about 75 years of useful life for recreation and fish production. These reservoirs can be stocked with fish such as bass, bream, and channel catfish for sport fishing. The fishing in these reservoirs will provide for approximately 10 to 20 man-days of fishing per acre per year or about 20 to 40 pounds of harvestable surplus production per acre per year.

The reservoirs will attract waterfowl and shore birds. They should receive some use by migrating ducks which travel this route each fall and spring. Controlled waterfowl hunting areas could be established along the shallow edges and in the upper ends of the lakes. Some wetland wildlife which are expected to use these reservoirs are the Killdeer and Snipes.

The floodwater retarding structures will provide some limited recreational activities to the landowners and others. These limited activities may cause a slight accumulation of litter around the impoundments. In the event accumulated litter becomes a problem, the county health department will inspect these sites to assure that no unhealthful conditions exist. The county health officer has the legal authority under Alabama law to inspect these sites. The sponsors will be responsible for any cleanup necessary around the impoundments.

The forestry measures will reduce runoff and erosion from the forested uplands thus protecting and enhancing on-site values while minimizing the volume of floodwater and sediment reaching the bottomlands.

There will be a net loss of 980 acres of forest land capable of producing high quality sawtimber during the next decade. There will be an increase of sediment from runoff on those areas converted to cropland and pastureland. Forest land cleared also involves a loss to wildlife habitat from reduction of mast production for squirrel and deer food.

The conversion of 470 acres of open land to forest land in the uplands will reduce erosion and sedimentation in those areas of upland without vegetative cover.

There will be some increase of low herbs, forbs, and shrubs as food to benefit wildlife to some extent until the tree stands reach sufficient crown closure to shade them out in the reforested uplands.

PROJECT BENEFITS

Project benefits from the installation of land treatment measures amount to \$2,100 annually, a damage reduction of 5 percent. Damage reduction benefits accruing to crops and pasture total \$29,600 annually. Indirect damage reduction benefits amount to \$3,100.

Average annual benefits in the amount of \$1,400 (Table 5) result from reduction of damages to minor fixed improvements, such as fences, water gaps, farm bridges and farm drainage systems.

After the project is installed, annual benefits of \$450 will be realized as a result of reduced damages to roads and bridges in the watershed.

The damage reduction benefits accruing to structural measures amount to \$35,000 annually and represent a 67 percent reduction in flood damages.

Benefits from more intensive use of existing cropland amount to \$11,900 annually on approximately 730 acres. These benefits were calculated on the basis of increased yields as a result of improved managerial practices made possible by the reduction of flood hazards. The increased yields occur on land used for soybeans,

Redevelopment benefits associated with watershed project measures amount to \$9,000 annually. These benefits result from employment of additional local labor during the project installation period. It is estimated that 30 man-years of employment will be created by construction of the proposed project measures.

The value of local secondary benefits amount to \$4,800 annually. They accrue as a result of increased net income to producers and processors of farm products, and to suppliers of farm equipment and material required to achieve the increased agricultural production made possible by the project. Secondary benefits from a national viewpoint were not evaluated.

The floodwater retarding structures will provide at least two types of incidental benefits which were not evaluated. The reservoirs will provide some recreation¹ in the form of fishing and picnicking to local residents. The reservoirs will also provide water for livestock during prolonged droughts.

Unevaluated benefits of the land treatment program include improved hydrologic condition and soil stability, thus minimizing storm water runoff from these lands and reducing the potential for flood and sedimentation damages to downstream lands. Increased productivity and improved quality of agricultural products will accrue as additional benefits of the program.

COMPARISON OF BENEFITS AND COSTS

Average annual benefits without local secondary benefits amount to \$55,900. The average annual cost will be \$45,700; therefore, the benefit-cost ratio without local secondary benefits will be 1.2:1.0.

Total average annual benefits accruing to structural measures amount to \$60,700; and the average annual cost will be \$45,700, with a benefit-cost ratio of 1.3:1.0 (Table 6).

PROJECT INSTALLATION

Land treatment measures will be established during the 5-year installation period by individual farmers in cooperation with the Lowndes and Dallas County Soil and Water Conservation Districts. The districts will provide technical assistance for planning and application of project measures. Landowners will receive financial assistance through the Rural Environmental Assistance Program in installing land treatment measures. The Soil Conservation Service, using P. L. 566 funds, will supplement technical

assistance provided under the going district program. This additional assistance will accelerate the rate of planning and application of land treatment measures.

Treatment of the critical areas will be accomplished through a division-of-work agreement. The Soil Conservation Service, using P. L. 566 funds, will provide seed, fertilizer, mulch, and necessary shaping. The sponsors, through a cooperative agreement with landowners, will be responsible for seedbed preparation and apply seed, fertilizer and mulch. The value of the work which the Service is to perform does not exceed cost-sharing rates for such practices applicable under other going programs.

Forest landowners will be encouraged to apply and maintain the recommended forestry measures on their land. Technical assistance, now provided by the Alabama Forestry Commission in cooperation with the U. S. Forest Service under the Cooperative Forest Management Program will be increased to accelerate the installation of forestry measures.

The Mush Creek Watershed Conservancy District, organized under Alabama statutes, will be responsible for all land rights needed for the installation of structural measures. The Dallas County Commission will assist the Conservancy District with necessary road and bridge relocations. All powers granted by the state, including the power of eminent domain, will be used to achieve project objectives. Most landowners have been contacted regarding necessary land rights.

The Soil Conservation Service will prepare plans, specifications, and cost estimates; provide construction inspection; and co-operate in the final inspection. The Dallas County Commission will install structural measures by contract during the 5-year installation period.

Sponsors set as the installation sequence the installation of Structure No. 2 first, then Structure No. 5.

If any archaeological sites are discovered prior to or during construction which might be affected by the installation of the structural measures, notification will be given to the Chairman, Department of Anthropology University of Alabama; Chairman of Alabama Historical Commission, State Department of Archives and History; and U. S. Department of Interior.

FINANCING PROJECT INSTALLATION

The Soil Conservation Service, under authority of the Watershed Protection and Flood Prevention Act (P.L. 566, as amended), will provide financial and technical assistance in carrying out the project works of improvement. The sponsors, using other authorities and private funds, will provide their share of the cost for installation of the planned works of improvement. It is not expected that any funds will be borrowed from the Farmers Home Administration. Availability of financial and other assistance to be furnished by the Soil Conservation Service under Public Law 566 and other authority is contingent on appropriations of funds for this purpose.

Landowners cooperating with the Soil and Water Conservation Districts will install land treatment measures. Cost-sharing may be available under the Rural Environmental Assistance Program to assist in applying these measures. The critical area treatment will be financed on a division-of-work basis with the Soil Conservation Service using P. L. 566 funds financing material and the sponsors financing the application of materials.

Except for technical assistance, the costs of installing forestry measures on private land will be borne by the landowner. It is expected that cost-sharing assistance will be available under the Rural Environmental Assistance Program.

The Dallas County Commission will provide contracting services and install the structural measures. The Mush Creek Watershed Conservancy District will provide all necessary land rights. The sponsors expect that land rights will be donated by interested landowners. The sponsors will obtain the entire land rights before any P. L. 566 assistance is provided for construction.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be operated and maintained by landowners under cooperative agreements with Dallas and Lowndes Counties Soil and Water Conservation Districts. The Soil Conservation Service will provide necessary technical assistance through the districts for operation and maintenance of land treatment measures.

The forest land treatment measures installed on private land will be maintained by the landowners or operators with technical assistance furnished by the Alabama Forestry Commission in cooperation with the U. S. Forest Service under the going Cooperative Forest Management Program.

Fire protection will continue to be provided by the Alabama Forestry Commission under the going Forest Fire Control Program.

The cost of operating and maintaining the proposed structural measures is estimated at \$1,000 annually. The Dallas County Commission will be responsible for the operation and maintenance of Structure No. 2 and the Lowndes County Commission will be responsible for Structure No. 5. The Mush Creek Watershed Conservancy District will assist in performing operation and maintenance of the kind that can be accomplished with normal farm equipment. Vegetation on structures and adjacent areas will need to be adequately fertilized to maintain a vigorous growth for protective ground cover. Trash racks and emergency spillways will need periodic cleaning.

A representative of the local sponsoring organization will make periodic inspections to determine the conditions of structural measures. A record of maintenance inspections and operations will be on file with the sponsoring organizations. The Soil Conservation Service will assign an employee responsibility for operation and maintenance inspections. This employee will make a joint inspection annually, after severe floods, and after the occurrence of any other unusual conditions that could adversely affect the structural measures. These inspections will occur for three years following installation of each structure. Inspections after the third year will be made annually by the sponsors. They will prepare a report and send a copy to the Service employee responsible for operation and maintenance inspections. In situations where the sponsors demonstrate lack of ability to properly carry out inspections or where conditions indicate need for continued Service assistance, the Service may continue to provide assistance after the third year. These continued inspections must be for situations as determined by the state conservationist.

The Service employee responsible for operation and maintenance inspections will review the sponsors' reports. Evidence that inspections or needed maintenance are not being properly and timely performed will be reported to the state conservationist, who will take appropriate action on the reported deficiencies.

Specific operation and maintenance agreements will be executed prior to issuance of invitations to bid on all structural measures.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Mush Creek Watershed, Alabama

Installation Cost Item	Unit	Number		Estimated Cost (Dollars) 1/				TOTAL
				P. L. 566 Funds		Other Funds		
		Non-Fed. Land	Total	Non-Fed. Land	Total	Non-Fed. Land	Total	
LAND TREATMENT								
Soil Conservation Service								
Cropland	Ac.	2,100	2,100			56,400	56,400	56,400
Grassland	Ac.	6,300	6,300			213,500	213,500	213,500
Miscellaneous Land	Ac.	565	565			36,500	36,500	36,500
Critical Areas	Ac.	103	103			5,600	5,600	5,600
Technical Assistance						5,000	5,000	14,800
SCS Subtotal				30,100	30,100	317,000	317,000	347,100
Forest Service								
Forest Land Treatment	Ac.	6,250	6,250			94,400	94,400	94,400
Forest Fire Control						12,000	12,000	12,000 2/
Technical Assistance						3,700	3,700 3/	17,800
FS Subtotal				14,100	14,100	110,100	110,100	124,200
TOTAL LAND TREATMENT				44,200	44,200	427,100	427,100	471,300
STRUCTURAL MEASURES								
Construction								
Soil Conservation Service								
Floodwater Retarding Structure	No.	2	2	579,100	579,100			579,100
Subtotal-Construction				579,100	579,100			579,100
Engineering Services								
Soil Conservation Service				39,500	39,500			39,500
Subtotal-Engineering				39,500	39,500			39,500
Project Administration								
Soil Conservation Service								
Construction Inspection				60,300	60,300			60,300
Other				37,100	37,100	1,000	1,000	38,100
Subtotal-Administration				97,400	97,400	1,000	1,000	98,400
Other Costs								
Land Rights						109,900	109,900	109,900
Subtotal-Other						109,900	109,900	109,900
TOTAL STRUCTURAL MEASURES				716,000	716,000	110,900	110,900	826,900
TOTAL PROJECT				760,200	760,200	538,000	538,000	1,298,200
SUMMARY								
Subtotal SCS				746,100	746,100	427,900	427,900	1,174,000
Subtotal FS				14,100	14,100	110,100	110,100	124,200
TOTAL PROJECT				760,200	760,200	538,000	538,000	1,298,200

1/ Price base 1972

2/ Includes \$8,700 going Cooperative Forest Fire Control and \$3,300 Cooperative Forest Fire Control acceleration.

3/ Includes \$1,100 going Cooperative Forest Management program.

Date: May 1972

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Mush Creek Watershed, Alabama

Measures	Unit	Applied To Date	Total Cost (Dollars) ^{1/}
<u>LAND TREATMENT</u>			
Conservation Cropping System	Ac.	2,000	24,000
Grassed Waterways	Ac.	14	2,520
Terraces	Ft.	70,000	2,800
Drainage	Ft.	77,575	77,575
Field Borders	Ft.	22,000	2,640
Pasture & Hayland Planting	Ac.	3,834	153,360
Farm Ponds	No.	18	18,000
Tree Planting	Ac.	950	22,300
Stand Improvement	Ac.	200	3,000
Forest Fire Protection	Ac.	22,200	16,000
TOTAL			322,195

^{1/} Price base 1972Date: May 1972

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Mush Creek Watershed, Alabama

(Dollars)^{1/}

Item	Installation Cost P.L. 566 Funds			Installation Cost - Other Funds		Total Installation Cost
	Construction	Engineering	P. L. 566 Total	Land Rights	Total Other	
Floodwater Retarding Structures:						
No. 2	238,600	19,100	257,700	46,700 ^{2/}	46,700	304,400
No. 5	340,500	20,400	360,900	63,200	63,200	424,100
Subtotal	579,100	39,500	618,600	109,900	109,900	728,500
Project Administration			97,400		1,000	98,400
GRAND TOTAL	579,100	39,500	716,000	109,900	110,900	826,900

^{1/} Price base 1972.^{2/} Includes \$15,000 for road relocation and \$4,000 for relocation of utility lines.

Date: May 1972

TABLE 3 - STRUCTURE DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY
Mush Creek Watershed, Alabama

Item	Unit	Structure Number		TOTAL
		2	5	
Class of Structure		a	b	
Drainage Area	Sq. Mi.	9.43	15.97	25.40
Curve No. (1 day) (AMC II)		78	82 ^{3/}	
Tc	Hrs.	2.13	4.40	
Elevation Top of Dam	Ft.	267.9	256.2	
Elevation Crest Emergency Spillway	Ft.	265.9	251.8	
Elevation Crest Low Stage Inlet	Ft.	241.3	234.6	
Maximum Height of Dam	Ft.	42	36	
Volume of Fill	Cu. Yds.	272,900	356,900	629,800
Total Capacity	Ac. Ft.	4,157	6,854	11,011
Sediment Submerged 1st 50 years	Ac. Ft.	394	356	750
Sediment Submerged 2nd 50 years	Ac. Ft.	400	366	766
Sediment Aerated	Ac. Ft.	33	31	64
Retarding	Ac. Ft.	3,330	6,101	9,431
Surface Area				
Sediment Pool	Ac.	71	142	213
Retarding Pool	Ac.	240	587	827
Principal Spillway				
Rainfall Volume (Areal) (1 day)	In.	8.80	8.53	
Rainfall Volume (Areal) (10 day)	In.	15.20	14.99	
Runoff Volume (10 day)	In.	9.71	10.522 [/]	
Capacity of Low Stage (Max.)	Cfs.	178	309	
Frequency Operation-Emergency Spillway	% Chance	2	2	
Size of Conduit (Dim.)	In.	36	48	
Emergency Spillway				
Rainfall Volume (ESH) (Areal)	In.	6.80	9.31	
Runoff Volume (ESH)	In.	4.31	6.36	
Type		veg.	veg.	
Bottom Width	Ft.	100	400	
Velocity of Flow (Ve)	Ft./Sec.	no flow	no flow	
Slope of Exit Channel ^{1/}	Ft./Ft.	0.035	0.025	
Maximum Water Surface Elevation	Ft.	no flow	no flow	
Freeboard				
Rainfall Volume (FH) (Areal)	In.	9.60	16.30	
Runoff Volume (FH) ^{2/}	In.	7.65	13.93	
Velocity of Flow (Ve)	Ft./Sec.	5.6	9.6	
Maximum Water Surface Elevation	Ft.	267.4	256.2	
Capacity Equivalents				
Sediment Volume	In.	1.64	0.88	
Retarding Volume	In.	6.62	7.16	

^{1/} Based on 25 percent of discharge

^{2/} Used an AMC of $\frac{II+III}{2}$

^{3/} Curve No. (1 day) (AMC $\frac{II+III}{2}$)

Date: May 1972

TABLE 4 - ANNUAL COST
Mush Creek Watershed, Alabama
(Dollars)^{1/}

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance Cost	Total
Floodwater Retarding Structures Nos. 2 & 5	39,400	1,000	40,400
Project Administration	5,300		5,300
GRAND TOTAL	44,700	1,000	45,700

^{1/} Price base: installation 1972, O&M adjusted normalized.

^{2/} 100 years at 5 3/8 percent interest

Date: May 1972

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Mush Creek Watershed, Alabama

(Dollars)^{1/}

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	44,400	14,800	29,600
Other Agriculture	1,700	300	1,400
Nonagricultural (roads and bridges)	600	150	450
Subtotal	46,700	15,250	31,450
Sediment			
Overbank deposition	300	50	250
Subtotal	300	50	250
Erosion			
Flood Plain Scour	3,800	1,500	2,300
Subtotal	3,800	1,500	2,300
Indirect	4,600	1,500	3,100
TOTAL	55,400	18,300	37,100

^{1/} Price base adjusted normalizedDate: May 1972

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Mush Creek Watershed, Alabama

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS ^{1/}					Average Annual Cost ^{3/}	Benefit-Cost Ratio
	Damage Reduction	More Intensive Land Use	Redevelopment	Secondary	Total		
Floodwater Retarding Structures Nos. 2 & 5	35,000	11,900	9,000	4,800	60,700	40,400	1.5:1.0
Project Administration						5,300	
GRAND TOTAL	35,000 ^{2/}	11,900	9,000	4,800	60,700	45,700	1.3:1.0

^{1/} Price base 1972.^{2/} In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$2,100 annually.^{3/} From Table 4Date: May 1972

INVESTIGATIONS AND ANALYSES

Economic

Basic data used for the economic investigations and analysis were obtained from local farmers, agricultural workers, experiment stations, and Department of Agriculture publications. Projections were based on these interviews, available soils information and agricultural projections.

Project benefits and operation and maintenance costs were based on adjusted normalized price data included in the Interim Price Standards for Planning and Evaluating Water and Land Resources, April 1966. Current prices (1972) were used for estimating the cost of land treatment and structural measures. The cost of all structural measures was amortized over a 100-year period using an interest rate of 5 3/8 percent.

Landowners and operators in the flood plain were interviewed to determine present land use and yields, projected use and yields with protection from flooding, and percent damage factors to crops and fixed improvement by depths of inundation. Projected crop distribution was determined from a summary of schedules, trends of the area and agricultural projections. Flood damages with and without the project were determined by using a synthetic storm series in the ECON 2 computer program.

More intensive use benefits were calculated on the basis of the expected increase in crop yields. This increase in yields will result from increased use of fertilizers and better managerial practices made profitable by reduced flood hazard. Flood damages to these higher values were deducted from gross benefits.

Land damage benefit calculations from flood plain scour and overbank deposition were based on the method where damage and recovery are in equilibrium. Recovery of productivity is occurring at approximately the same rate as damage.

Data furnished by the geologist and used in the evaluation included area damaged, percent reduction in yield, and amount of damage that is recoverable. Other information on prices, costs, and returns for crop production complete the basic data. The percent reduction was determined by using the method in Chapter 5 of the Economics Guide.

The evaluation of local secondary benefits stemming from the project was derived by applying a 10-percent factor to the sum of all primary project benefits (excluding indirect and redevelopment benefits). Local secondary benefits induced by the project were based on the difference in total production cost of crops and pasture with and without project. A 10-percent factor was applied to this difference in production cost and also to the annual equivalent associated cost to get the gross annual secondary benefits.

Redevelopment benefits resulting from installation of project measures are based on utilization of unemployed local labor. The amount of con-

struction cost spent for local labor was estimated to be about 30 percent based on interviews and available performance records from other watersheds. Thirty percent of the construction cost was converted to an annual equivalent by amortization at $5 \frac{3}{8}$ percent interest over a 100-year period.

The value of land rights including the estimated cost of road and bridge alterations was furnished by the Mush Creek Watershed Conservancy District. These land values were compared with values of comparable land in the watershed. Estimates were based on current market values. The loss of net income in the pool areas of the floodwater retarding structures was found to be less than the amortized value of land rights; therefore, there are no other economic costs applicable to the project.

Forestry

A systematic field survey conducted by the U. S. Forest Service with assistance from the Soil Conservation Service and the Alabama Forestry Commission yielded information on forest cover, hydrologic conditions, disturbance factors, improvement potential and treatment needs.

Hydraulic and Hydrologic

Consideration was given to soil classification, land use, and vegetative cover in determining the antecedent moisture condition II future curve number 76 for the watershed. This curve number was used in accordance with Technical Release No. 16, "Rainfall-Runoff Tables for Selected Runoff Curve Numbers", in determining inches runoff for the storms routed.

The convex method of valley flood routing was performed using the IBM 1130 computer and Technical Release 20, "Project Formulation Program--Hydrology". Ten storms, selected from the U. S. Weather Bureau Publication Rainfall Frequency Atlas of the United States, Technical Paper No. 40", were valley flood routed through the watershed for Alternatives 1 and 2. Alternate 1 was future condition without project and Alternate 2 was future condition with Floodwater Retarding Structure Nos. 1, 2, and 3 installed. Storms routed were the 100-year, 25-year, 2.33-year, 2-year, 0.75-year, 0.5-year, 0.3-year, and 0.15-year frequency, 24-hour duration storms. Routed discharges of storms smaller than the 10-year event exceeded corresponding discharges indicated by a Log Pearson Type III flow-frequency analysis of records from a stream gage on Mush Creek at a bridge on State Highway 41, three miles south of Sardis. Frequencies of these storms were adjusted to correlate routed discharges and those measures at the gage. Thus, the storms routed for Alternates 1 and 2 were the 100-year, 25-year, 10-year, 3.33-year, 2.94-year, 1.67-year, 1.35-year, 1-year, 0.67-year, and 0.33-year frequency 24-hour duration storms. Alternate 3 was a rerun of future condition without project with routing reaches to correspond with those used in Alternate 4. Alternate 4 was future condition with Floodwater Retarding Structures Nos. 2 and 5. Three storms, the 2.94-year, 1.35-year, and 0.67-year, were deleted prior to routing Alternates 3 and 4. Alternate 4 was found to be the only alternate to give the desired reduction in floodwater damages and was proposed for installation.

Stages versus discharges and end areas were developed for 20 valley cross-sections with the use of the IBM 1130 computer and field data collected at the cross-section locations. Stage versus acres inundated were also developed for 18 of the above cross-sections that represented acres of flood plain. Stage-discharge relationships were developed for an additional 36 channel cross-sections by use of Manning's formula.

Geologic

A geologic map and report ("Bulletin 48, Notes on Deposits of Selma and Ripley Age in Alabama") were reviewed and observations of field conditions were made. Preliminary damsite investigations were performed at two locations. The investigations included surface inspection and a number of hand auger borings. Geologic problems of damsites are expected to be similar. Foundation conditions should be good. The borrow and foundation materials will be mostly slow-draining sandy clays with a moderately high plasticity, probably classified as CL's or CH's in the Unified Soil Classification System. No rock excavation is anticipated at either damsite, nor should there be any drainage or leakage problems.

Sedimentation

Sediment storage calculations were based on the drainage areas above the two sites in which land use, cover conditions, slope and length of slope were mapped in detail. The damsites have similar topography. A modification of the Musgrave Soil Loss Equation was used to estimate erosion rates. Sediment delivery ratios were estimated using a curve relating size of drainage area and gross erosion in the Texas Blackland Prairies Land Resource Area. Sediment storage requirements were projected for 100-year life of structure using the present erosion rate averaged for 10 years and the predicted future rate for 90 years. The sediment pool elevation is set by the capacity required to store the predicted submerged sediment accumulation. Additional capacity for aerated sediment is provided in the detention pool for that portion of the sediment estimated to remain above the sediment pool elevation. Volume weights used for converting erosion to sediment were 48 pounds per cubic foot for submerged sediment, and 75 pounds per cubic foot for aerated sediment.

Flood plain scour and sediment damages were estimated by mapping the damage on valley cross-sections and expanding the damage to the acreage represented by the sections. Some flood plain sedimentation occurs, but the sediment deposits are widespread and fine-grained and the resulting damage is only slight.

Engineering

Five damsites were investigated with two planned for installation (see project map, Figure 1). Planning investigations indicated that the structures alone would give an acceptable level of flood protection and meet other project objectives.

The principal spillway design storm for each site was computer-routed through various pipe sizes with single-stage and two-stage inlets. Appropriate pipe sizes and type inlets were selected based on cost and feasibility so as to meet project objectives.

After the appropriate principal spillway was selected, the emergency and freeboard design hydrographs for each site were computer routed using various emergency spillway dimensions. No spillway dimension was selected where the required excavation provided more than 30 percent of embankment material. The topographic conditions that were most economical and best met the project objectives were used in selecting the spillway dimensions for each site.

Fish and Wildlife

A field study was made by biologists from the Bureau of Sport Fisheries and Wildlife, Alabama Department of Conservation, and the Soil Conservation Service. The general quality and quantity of habitat for both fish and wildlife were determined. Wildlife habitat was checked at various points throughout the watershed to determine its suitability for the major species of game and furbearers. Streams were checked for evidence of use by fishermen and local people were questioned about fishing success.

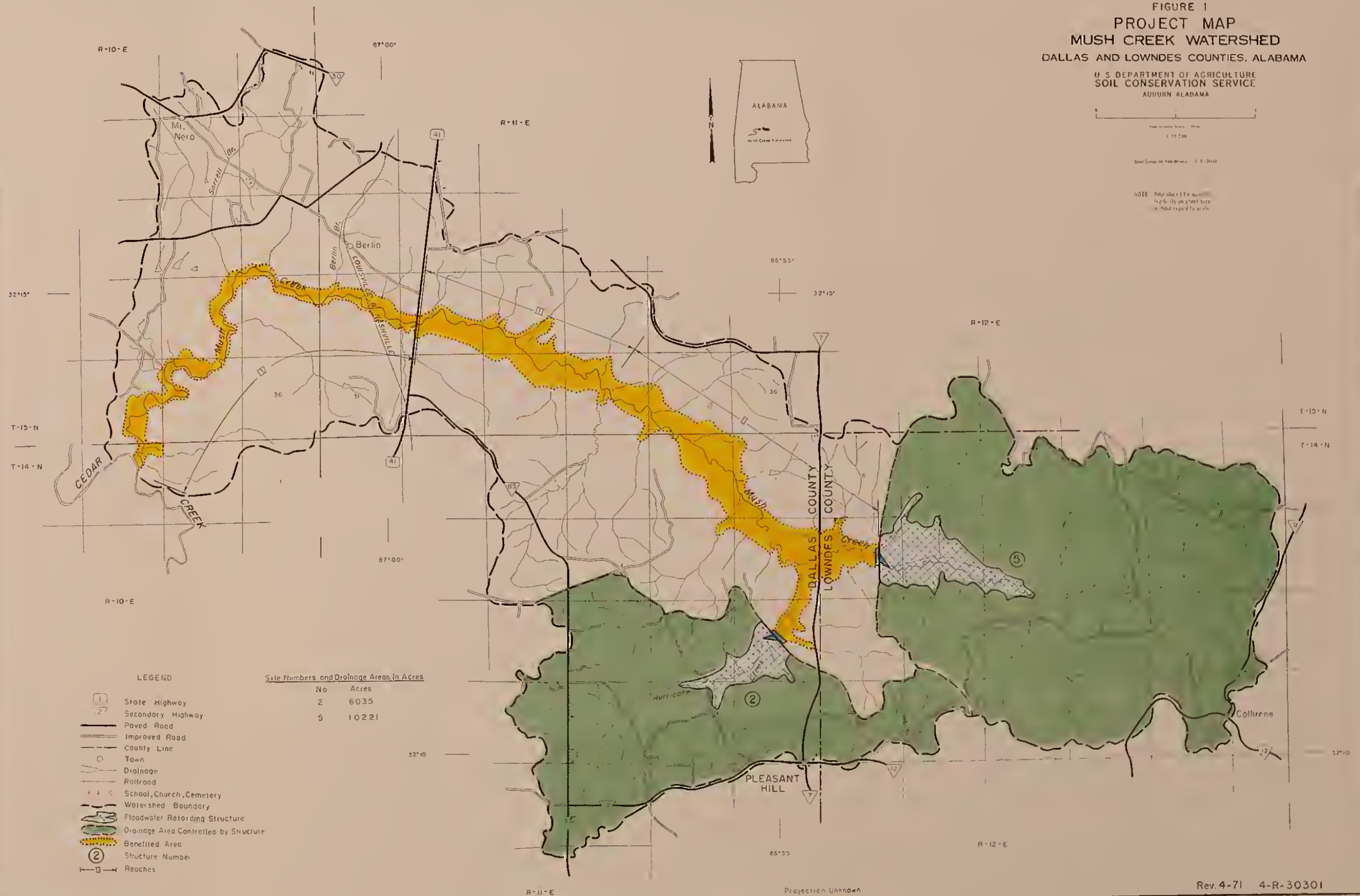
FIGURE 1
PROJECT MAP
MUSH CREEK WATERSHED
DALLAS AND LOWNDES COUNTIES, ALABAMA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AUBURN, ALABAMA



Scale Contour Map Projection: U. S. 2011

NOTE: Reproduction of this map is prohibited without regard to scale.



LEGEND

- 1 State Highway
- 27 Secondary Highway
- Paved Road
- Improved Road
- County Line
- Town
- Drainage
- Railroad
- School, Church, Cemetery
- Watershed Boundary
- Floodwater Retarding Structure
- Drainage Area Controlled by Structure
- Benefited Area
- Structure Number
- Reaches

Site Numbers and Drainage Areas in Acres

No	Acres
2	6035
5	10221

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MAY 1968

4-R-26449



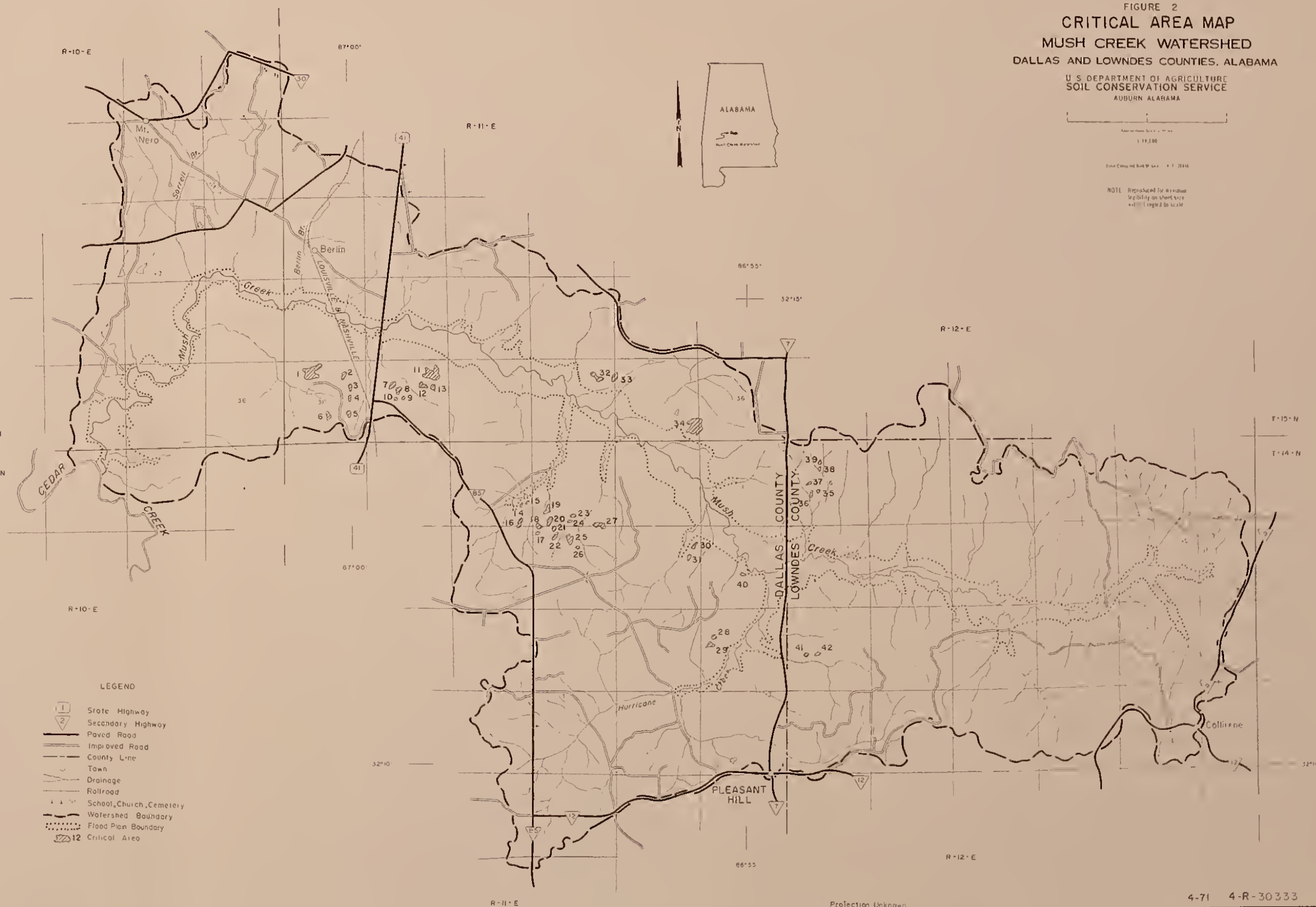
FIGURE 2
CRITICAL AREA MAP
MUSH CREEK WATERSHED
 DALLAS AND LOWNDES COUNTIES, ALABAMA
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 AUBURN, ALABAMA



1:17,186

Date Compiled: 10/19/66

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LEGEND

- State Highway
- Secondary Highway
- Paved Road
- Improved Road
- County Line
- Town
- Drainage
- Railroad
- School, Church, Cemetery
- Watershed Boundary
- Flood Plain Boundary
- Critical Area

Projection Unknown

4-71 4-R-30333

MAY 1968

4-R-26646

